LHC Integration of a Crab Cavity (Summary & Update of a talk at BNL WS)

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Legend:

❤ : could / should (compatibility) be obtained/made by CERN,

(**but no promises of delivery today**)

✱ : in radiation shielded area

The Mont Blanc as seen from Meyrin
400 mm lens, © J.T.

Survey (single, temporary CC) **: best location at IP4** (ex-ALEPH)

- beam line centers are separated by 42 cm: enough lateral space
- the space foreseen for the 200 MHz capture cavities (+) is still free

  (but might get needed for increasing beam current, at least 1 year forewarning)
- the space reserved for the transverse damper reserve is still free

  (but might get needed for increasing beam current, forewarning: fabrication time)
- the 400 MHz main RF is at IP4: RF infra-structure exists

  (RF reference, cooling water, …) (but no guarantee for simple hook-up)
- foreseen location for the transmitters for the capture cavities is less than 100m away from CC (RF loop gain ≥ 100) –> place CC transmitter there **(radiation protected area)**

(+) staged

• Cryogenic liquids exist at IP4 with T ≤1.9K and 4.5K

BUT

- pressure rises to 20 bar when magnet quench -> saftety system (❤ as for main RF)
- the 1.9K LHe is repressurized at 1 bar, not boiling ->

not directly usable for sc. cavities

• LHe operational T (2 or 4.5K) still open

- if 4.5 K: 'steal' at main RF / equivalent system apart (❤)
- if 2 K: (small) cold compressor for CC/ tapping ??

• **cryo supply** to be settled **with AT-CR** (cut metal !) (❤ ❤ ❤)

most complex part of the set-up

Additional installations in the tunnel & LEP's klystron gallery

- 800 MHz transmitter at a few 10 kW (✱, ❤)
  - RF group needs (for SPS) exactly such amplifiers –> use spare
- HV supply (✱, ❤) for transmitter (a few 10 kV for IOT or klystron)
  – main transformer on ground level / hook onto main RF supply ?
- cooling water for transmitter: main RF klystrons 'next door' …(❤)
- cooling water (❤) HOM dump cooling (if KEK/Cornell HOM design)
- compressed air (❤) (open/close [RF shielded] beam valves (❤))
- 240 / 3x400 V supply (❤) for removable vacuum pumps (❤),….
- High voltage cable (❤) for ion sputter pump (❤), HV supply (✱, ❤)
- connection (❤) to data bus (controls net-work (✱)) and cryo-controls
- control electronic crates (✱, {❤})

(✱) in radiation shielded area

Requirements for cryo-module:

- stable support (with wheels ?) and solid anchor-points (shaft !)
- Exterior dimensions - including non-detachable parts (coupler(s), ..)
  - fit LHC transport zone: 'roll' CC module to its place
  - once CC placed: leave room for other LHC components to pass
- remote controlled transverse positioning of cavity and/or cryostat
- valve/JT[1] cold box on module ? (to be discussed with AT-CR)
- He rupture disk (♥) & self-closing (small) tap (♥)
- matching taps (♥) for cryogenic liquid/gas, 'warm' return gas
- LHe level gauge (♥), He pressure gauge (♥)
- dedicated T-sensors (♥) for cool-down, survey when 'warm idling'

[1] Joule-Thomson

Thank you for your attention!